DOCUMENT RESUME

ED 275 774 UD 025 184

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TITLE Schooling, Tracking, and Teenage Intelligence.
INSTITUTION Wisconsin Univ., Madison. Center for Demography and Ecology.
SPONS AGENCY Haifa Univ. (Israel).; National Inst. on Aging (DHHS/NIH), Bethesda, MD.
PUB DATE Sep 86
GRANT PO1-AG04877-01
NOTE 33p.; This is a revised version of a paper presented at the Annual Meeting of the American Sociological Association (Washington, DC, August 26-30, 1985).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Academic Ability; Dropouts; *Educational Attainment; *Foreign Countries; *Intellectual Development; *Intelligence Differences; *Outcomes of Education; School Effectiveness; Secondary Education; Student Characteristics; *Track System (Education)
IDENTIFIERS *Israel

ABSTRACT

The extent to which schooling brings about change in the rank order of students along the hierarchies of intelligence is a pervasive sociological concern. Until quite recently the emerging consensus was that schooling is relatively ineffective in this regard and that intelligence is largely exogenous to the educational process. A study to determine the effects of schooling and tracking in Israeli high schools on intellectual change during adolescence was conducted, and the findings are presented in this report. Longitudinal data for a sample of young Israeli men born in 1954 were analyzed. Most respondents attended some form of secondary education, but quite a few dropped out by the end of primary school. Early dropping out was found to have a strong effect on later verbal intelligence. Among students, in contrast, the effects were much weaker. In addition, duration of secondary education and track have direct and significant effects on later intelligence, demonstrating a continuing capacity in adolescents for intellectual development (both gains and losses). Fifty-one references are appended. (Author/KH)

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ED275774

Schooling, Tracking, and Teenage Intelligence

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September, 1986

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This is a substantially revised version of an earlier paper which was presented at the 1985 Annual Meetings of the American Sociological Association, Washington, D.C. This research was supported by the University of Haifa, the National Institute of Aging (PO1 AG04877-01), and the Graduate School of the University of Wisconsin-Madison. The authors thank Nancy Denney, Moshe Zeidner, David Budescu, and Nao Tsunematsu for helpful comments.

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ABSTRACT

The extent to which schooling brings about change in the rank order of students along the hierarchies of intelligence is a pervasive sociological concern. Until quite recently the emerging consensus was that schooling is relatively ineffective in this regard and that intelligence is largely exogenous to the educational process. This paper is concerned with the effects of schooling and tracking in Israeli high schools on intellectual change during adolescence. Longitudinal data for a sample of young Israeli men of a single birth cohort are analyzed. Most respondents attended some form of secondary education, but quite a few dropped out by the end of primary school. Among early drop-outs we find strong effects of early on later verbal intelligence. Among students on the other hand, the effects are much weaker. In addition, duration of secondary education and track have direct and significant effects on later intelligence, demonstrating a continuing capacity in adolescents for intellectual development (both gains and losses).

Since the appearance of the "Coleman Report" (Coleman et al., 1966) and the publication of Inequality (Jencks et al., 1972) researchers have grown increasingly skeptical of the importance of school characteristics as determinants of cognitive attainment. Among the school characteristics listed are budgets, teachers' qualifications, the socioeconomic and intellectual characteristics of peers, and the nature of the curricula. Researchers also are skeptical of the effects of schooling (i.e. educational attainment) on cognitive growth (Jencks et al., 1972, chapter 3).

Skepticism regarding the importance of schooling and school characteristics for intellectual change emerges from analyses conducted in the United States. When similar models are applied to developing countries or to school systems which are more structured than those in the United States, different pictures emerge. For example, Hyneman and Loxley (1983) conducted a comparative study of the effects of school characteristics of cognitive achievement in developing countries. They found that in less developed countries (LDC's), the effects were very large relative to those obtained in the developed world and in the more developed of the LDC's. Shavit and Williams (1985) studied contextual school effects on the educational expectations of Israeli eighth graders; where schools did not track students, contextual effects were as large as the effects of some individual-level variables. In studies of the cognitive development of young (5 to 11 years olds) children in Peru, Stevenson and his associates (1978) found strong effects of exposure to schooling.

Some of the failure to discern substantial effects of American schools on the intellectual development of children may reflect the small range of variability among schools in aspects of curriculum, instruction, and resources and of duration of exposure to schooling especially at the primary and secondary levels. And yet, even in the U.S. some studies do demonstrate significant effects of both schooling and of school characteristics on cognitive achievements. Heyns' (1978) shows that cognitive growth of Black sixth graders accelerates during the school year and slows down during summer vacations. Wiley (1976) finds that variations in the length of the school year across schools is related to learning. Alexander et al. (1985) compare cognitive growth of high school drop-outs and graduates. They find that over two years, schooling benefits the cognitive growth of youngsters who persist in school by about a tenth of a standard deviation. Rosenbaum (1975, 1976) reports that tracking affects the rate of growth in scholastic aptitude. (See Weinert, in press, for a comprehensive assessment of the demonstrated effects of instructional techniques and educational practices in West Germany that vary between classrooms within schools, and between schools, and that influence intellectual development.)

These results, even in a nation whose educational system is relative homogenous across schools (when compared internationally; see Fend 1985), suggest that tested cognitive abilities associated with the performance of school work may rise at different rates, or even decay, in response to different regimens of exposure to schooling. This latter view of intellectual development as involving contextually-responsive plasticity (including losses as well as gains) contrasts with more traditional views of cognitive change as progressive, irreversible, universally age-graded and complete by adolescence

(e.g., Bloom 1964; compare Baltes et al., 1984).

A sociologically important meaning of measured intelligence is that it serves as a socially acceptable basis for the allocation of persons to positions in the socioeconomic hierarchy. It has been suggested repeatedly that the way in which intelligence is defined may be determined by the socioeconomic and cultural forms of domination (e.g., Bowles and Gintis 1976; Bourdieu & Passeron, 1977), viz., that dominant social groups manage to impose definitions of intelligence which enhance their relative standing on the intelligence scale. Whether consciously intended or not, the resulting mean IQ (psychometric intelligence) of dominant groups is usually higher than that of subordinate groups (e.g., Jencks et al., 1972; Minkowitch et al., 1981; Halsey et al., 1980). This may be due to the fact that intelligence scales are often constructed in order to predict future performance in school. Since curricula are reflective of dominant cultural forms (e.g., Bourdieu 1977), so must be the IQ tests if they are to have a predictive value. It is not surprising therefore, that measured intelligence and privilege are related.

The present investigation accepts the existence of cultural and class biases in the measurement, and indeed, in the concept of intelligence, but we treat them as baseline conditions. Going beyond these conditions, our principal objective is to study the manner and extent to which schooling, and the structural differentiation--namely, tracking--in a school system, further enhances or attenuates prior rank-ordered differences among individuals in psychometric intelligence during adolescence. The reason for this interest is clear: If educational experiences during adolescence are able to alter relative intellectual abilities, then schools are able to change the later life chances which depend upon measured intelligence (e.g., income and occupational

standing.) Whether the outcome results from adjustments of true abilities and performance capacities or from the "labeling" by test scores is beside the point of the analysis.

SCHOOLING, TRACKING, AND INTELLIGENCE

It is often assumed that school work provides students with an opportunity to practice general problem solving skills and to develop metacognitive strategies (e.g., mnemonic aids to memory) which facilitate performance on tests of intelligence (e.g., Zivian and Darjes 1983). Therefore, schooling is expected to enhance cognitive development, through duration of exposure and learning. However, curriculum and instruction, especially at the post-primary level, often are differentiated by track. Therefore, schooling should not be measured unidimensionally by duration alone. Thus, the effects of schooling may vary according to exposure to different tracks.

Where tracking is practiced, low ability students, and those of subordinate group origins, are more likely to attend the low (vocational or general) programs in which the curricula are less intellectually stimulating and in which time spent on cognitively demanding tasks is shorter than in the more selective (academic) tracks (e.g., Heyns 1974; Rosenbaum 1976; Hout and Garnier 1979; Shavit 1984; Lewin-Epstein 1982). For example, in Rosenbaum's (1975, 1976) study of a single American high school, tracking served to polarize the IQ distribution: College preparatory tracks not only enhanced the rate of measured cognitive growth but also diversified the IQ distribution. That is, some students with initially high levels of intelligence gained more than those who started out at the bottom of the scale. Conversely, non-college tracks inhibited and fostered decay of performance, whether by induced boredom

or the failure to provide daily practice. The effects which were reported by Rosenbaum were quite small, as have been the track effects reported by other studies which controlled for initial ability (e.g., Jencks et al., 1972, Chapter 3; Jencks and Brown 1975). This is not surprising given the inherent stability of intelligence past early childhood (e.g., Bloom 1964). Alexander and Cook (1982) illustrate that some of the track effects on aptitude are, as expected, due to the different curricula which are taught in the tracks.

Thus, we hypothesize two links between schooling and differential intellectual changes during adolescence. One is the mere duration of formal academic exposure, with students gaining more as a function of duration. A second link is qualitative rather than quantitative: Curricular tracks provide practice and motivation for the further development of different cognitive abilities. The college-preparatory tracks stress academic skills, whereas vocational tracks devote a considerable portion of the curriculum to practical training. By both these means schools have the capacity to alter the course of intellectual development beyond childhood and the effects of family background.

Coupled with the insight that neither intellectual abilities during childhood nor track placement in the adolescent years are randomly related to youth's socioeconomic origins, the role of tracking on the developmental profiles of teenagers from various socioeconomic strata can be marked. One can expect greater differentiation of classes or strata by cognitive performance where patterns of school attendance (duration) and track placement are strongly related to social origins, whether by procedures of sponsorship, contest, or tournament (Turner 1960; Rosenbaum 1976). Under this interpretation, schooling is a mediating mechanism in the process of stratification (Duncan, Featherman,

and Duncan 1972). It is an institution of continuity by which membership of class and stratum persists across parental and filial generations. At the same time, it can create opportunities for both socioeconomic and psychological changes, especially during adolescence but also throughout adulthood (see Featherman 1980, for review). The relative dominance of one over the other potentiality of the educational system is tied, in our analysis, to the social organization of the schools, namely to their degree of curricular tracking and to the differential lengths of their courses of instruction.

THE SETTING

The present investigation evaluates the developmental consequences of schooling and curricular tracking in a country where the secondary school system is highly differentiated. We examine patterns of change in verbal intelligence in a cohort of Israeli Jewish males born in 1954.

Until the early 1970s the Israeli educational system consisted of three stages: primary, post-primary (grades nine through twelve), and post-secondary education.[1] Since the mid-1960s, primary education has been nearly universal with about 95 percent of school cohorts completing eighth grade (State of Israel 1978, p. 14). Of primary school graduates, about 90 percent continued to some form of post-primary education. Broadly defined, post-primary education consists of two major types: academic and vocational.

Academic tracks prepare students for the matriculation examinations. A matriculation diploma is awarded to candidates who pass a series of comprehensive national examinations in the major areas of academic education. The curriculum in the academic track consists of about 38 weekly sessions in each of four years (Kleinberger 1969, p. 206-207). During the first two years

(grade nine and ten) twenty-two weekly sessions are devoted to the humanities and Jewish studies, ten sessions to arithmetic and sciences, and six weekly sessions to physical and social education. During the last two years (grades eleven and twelve) academic education is differentiated into areas of concentration (e.g., humanities, social sciences, physics, biology). The curriculum is then restructured accordingly. In the late 1960s about 40 percent of ninth graders attended an academic track.

Vocational education consists of 44 to 47 weekly sessions of which about ten are in the humanities and Jewish studies, six are devoted to arithmetic and science, three to physical and social education, and the rest to practical (18 sessions) and theoretical (5 to 12 sessions) vocational education (Kleinberger 1969, p. 221). The relative weight of practical training is heaviest during the first two years, whereas the theoretical component of vocational education is introduced in greater quantity during eleventh and twelfth grades. During the 1960s, vocational students were not presented or prepared for the matriculation diploma. Consequently, schools were under little pressure to keep pace with the prescribed curriculum or to maintain very high level of performance from their students. Furthermore, in the cohort, sixty percent of entering vocational track students discontinued by the end of tenth grade (Shavit-Streifler 1983, p. 147). Thus, less than half reached the level at which the theoretical aspects of the vocational curriculum are taught.

In sum, vocational students are exposed primarily to low level academic and to practical vocational education. By contrast, academic students spend most of their school time in academic education and are required either to keep pace or to drop out before the matriculation exam time. Indeed, of those

who reach grade 12 in the academic tracks, over 75 percent become eligible for a matriculation diploma.

In addition to the academic and the non matriculating vocational tracks there are numerous tracks. Some combine vocational or agricultural studies with preparation for the matriculation diploma while others stress religious studies. Since each of these tracks is small, we shall combine then into a residual 'other' category and discuss them only in passing.

Until the early 1970s, the major mechanism by which students were sorted into the various tracks was a national aptitude/achievement test (hereafter, Seker) which was administered to virtually all eighth graders during the first or second trimester. The test consisted of seven batteries in the areas vocabulary, text comprehension, reasoning, arithmetic and geometry (Ortar 1967). High scoring students were encouraged to apply to the academic post-primary schools while the remaining students were directed to the less selective, vocational tracks.

At age seventeen or so, most Israeli males are required to take the military screening tests. The tests consist of a modified version of the Raven progressions matrices test (Raven 1958) and of a test of verbal comprehension. Low ability students are typically placed in vocational tracks which, when compared to academic tracks, inhibit growth in intelligence. Thus, some of the constancy in teenage intelligence is due to ability-based educational selection.

DATA, VARIABLES AND METHODS

Data are drawn from a life-history study of a representative sample Jewish Israeli men of the 1954 birth cohort who were interviewed during 1980-81

(Matras et al., 1983; Shavit 1984). The interview consisted of extensive, retrospective life history questions about participation in numerous life domains since birth until time of interview (e.g., education, marriage, work, etc.).

The original sample consists of 2144 respondents. For 1210 respondents the interview data were merged with the Seker test scores which were drawn from the Ministry of Education files. For all but five of the 1210 cases, military test scores were then retrieved from the Military files. Thus, complete test score information is only available for 57 percent of the original sample.

In the appendix we evaluate the magnitude of sample selection bias which is due to sample attrition. We conclude that the only systematic source of bias is immigrant status. This reflects the simple fact that many immigrants did not take the Seker tests because they immigrated after eighth grade. Among Israeli natives, sample attrition does not introduces systematic bias. Thus, we only analyze data for a subsample of 955 respondents who constitute 68 percent of the 1470 Israeli born cases in the original total sample.

The means and standard deviations of the variables are presented in the first column of Table 1. The dependent variable in the analysis is the military score of verbal intelligence (VERBAL). Based on the verbal comprehension test scores in our analysis subsample are normalized to a mean of 100 and a standard deviation of 15. The reliability coefficient (coefficient alpha) of VERBAL is 0.82. Eighth grade intelligence (SEKER) is measured by a linear composite of the Seker sub-tests, all of which used verbal means to assess skill in the seven ability domains. The composite is reliable at 0.91.

The correlation between SEKER and VERBAL is 0.75 (0.87 when corrected for attenuation). Psychometric data are not available with which to evaluate more

precisely the comparability of SEKER and VERBAL. It is not known how these test scores would have correlated if they were administered contemporaneously. Nor do we know how each test would have correlated with some third test (e.g., Stanford-Binet) had it been administered to subjects at each age. We do know, however, that the correlation between the SEKER and the VERBAL scores falls within the range of intercorrelations of repeated measurements of school intelligence which have been reported for similar age ranges. For example, for ages thirteen to seventeen among American students Bloom (1964, p. 66-67) reports a range of correlations between 0.68 and 0.90. It should be noted however, that Bloom's correlations were computed in relatively homogeneous samples of school students among whom experiential variations in the inter-test period would have produced small differentiation of intelligence. Thus, our corrected correlation between Seker and the military verbal test, lies at the upper end of this range, which seems to suggest a reasonable comparability between the two measurements.

Furthermore, the military verbal test was intended as a measure of verbal ability whereas SEKER as a test of general scholastic intelligence, was designed to measure verbal as well as other abilities (e.g., reasoning, mathematical achievements). Thus, SEKER is probably a more general, exhaustive test than VERBAL. If VERBAL were to measure abilities which are not measured by SEKER, and if these abilities affect track placement or educational attainment, then the effects of schooling and/or tracking which we report below may here been upwardly biased (Coleman 1982). On the other hand, if Seker scores control for all abilities which are measured by VERBAL, than the fact that the two instruments are not identical should not bias the results. We are

unable to think of scholastic verbal abilities which are measured by VERBAL but not by SEKER[2].

Duration of school attendance is indicated by DURATION. It measures the number of months, between the beginning of ninth grade and age seventeen, during which the young men attended post-primary school. In computing this variable we excluded summer vacations in order to produce more accurate measures of actual exposure to schooling. Three dummy variables (ACAD, VOC and OTHER) are coded 1 if, respondent attended the appropriate track. POPED and MOMED measure the number of school years attended by father and mother. ETHNIC is a dummy variable coded 1 if a youth or either of his parents was born in an Asian or African country. NSIBS is number of one's siblings.

ANALYSIS

Our major analytic concern is with the effect of post-primary schooling and tracking on relative intelligence. We employ the term relative intelligence because the availability of two different measures of intelligence precludes an analysis of growth (or decay) based on explicit change scores in the inter-test period. However, we are able to study the determinants of change in one's rank order in the intelligence distribution of the cohort. Each of the scores is standardized separately around the age-specific mean of VERBAL and of SEKER for the subsample here analyzed. Thus, we can measure change in relative intelligence and relate it to a set of covariates.

In columns 2 through 5 of Table 1 we present the means and standard deviations of the social background variables, early and late scholastic intelligence, and duration of secondary education by track. Respondents who did not attend any secondary education have the least favorable social origins,

are more orthodox, and score lowest on the intelligence measures. The converse is true for academic track students.

The means of SEKER and VERBAL within each track are very similar, suggesting little overall change in the rank-ordering of the track-groups. The mean ranks of the out-of-school youth rise by about 2 points (82.4 is 84.2), which one would expect on the basis of the usual regression-to-the-mean. Similarly, the mean of vocational students rises by about 3.3 points (94.4 vs. 97.7). Surprisingly, the mean of academic students does not regress towards the mean but rises slightly (110.7 vs. 111.2).

More interestingly, the standard deviation of VERBAL is larger than that of SEKER among the out-of-school group but is smaller among the track categories. The reduction is most pronounced in the academic track (from 11.2 to 9.46). These changes in the dispersion of intelligence scores are not consistent with Rosenbaum's (1975) findings which were discussed earlier. Several explanations for this finding come to mind. First, the effect of earlier on later intelligence varies across the four categories: The larger the effect, the larger would be the variance of the later measure and vice versa. Second, that in the out-of-school group the reliability of VERBAL is low, and it contributes to the dispersion of the observed scores. Finally, in the out-of-school group, later intelligence is determined by a wider array of independent variables (e.g., by the nature of labor market experiences in the inter-test period) which introduce variability.

The first hypothesis is confirmed in our analysis. The second hypothesis cannot be tested, because we do not have access to the component scores which constitute VERBAL[3]. A test of the third hypothesis, especially as it relates to labor force experience, is intriguing (Kohn and Schooler 1983) but is in the

scope of the present paper.

In Table 2 we present results of several regressions of relative intelligence at age seventeen. The objective of the analysis is to evaluate the role of schooling and tracking in the constancy and change in relative intelligence in the inter-test period. In Model 1 VERBAL is regressed on SEKER. The regression coefficient (0.74) represents the overall stability in relative intelligence between ages 13 and 17.[4]

We assume that the overall correlation between early and later intelligence is due to three distinct components. First is the inherent stability of intelligence which is due to the developmental trajectory. That is, it is assumed that by age 13 individuals' relative intelligence has crystallize to a large extent. This component is represented by the direct effect of SEKER on VERBAL. Second is the spurious relationship between the two variables which is due to social origins; social origins may affect intelligence at both points in the life course. A third component of the correlation between SEKER and VERBAL is mediated by the duration and type of educational attendance in the inter-test period. Scholastically intelligent students are more likely to persist in school longer and to attend the academic track. If academic and longer education enhance one's relative intelligence, then schooling and tracking may be said to account for the degree of stability in relative intelligence.

The net effect of SEKER controlling for socioeconomic origins is 0.66 (Model 2). Thus, socioeconomic origins account for no more than eleven percent of the total effect of early on later intelligence. The effects of both parents' educational attainments are significant but of small magnitudes. The

effects of ethnicity, number of siblings and religious orthodoxy are not significant.

The net effect of Seker, controlling for type and duration of education is 0.63 (Model 3). The effect of length of schooling is significant and quite large. A year of schooling contributes 3.5 points to intelligence, or about a quarter of a standard deviation. The effects of the track categories are not significantly different from that of the out-of-school category.

In Model 4 VERBAL is regressed on all ten independent variables. The net effect of SEKER is now 0.57 which is 77 percent of its gross effect in Model 1. The only other significant effect in the model is that of educational duration.

We summarize provisionally that relative intelligence at age seventeen is determined primarily by the persistence of scholastic ability but that a significant portion of the gross relationship between early and late intelligence is due to educational attainment in the interim. The effect of tracking seems insignificant despite its high degree of curricular differentiation.

The next model in Table 2 includes interaction terms between early intelligence and track. The model tests for differences among the tracks in the slope of later on early intelligence. Recall that in the discussion of Table 1 we hypothesized that the slope is steepest among the out-of-school respondents. The hypothesis is confirmed. The main effect of SEKER is 0.92. This indicates that in the out-of-school category there is very high stability in relative intelligence. The effect of SEKER on VERBAL among students of the academic track is the sum of SEKER's main effect and the effect of its interaction with ACAD. Since the interaction effect is negative and

significant (-0.37), the total slope is significantly flatter than among the out-of-school category. We interpret this to indicate less stability of relative intelligence in the academic track. The magnitudes of the other two interactions of SEKER with track are very similar to its interaction with ACAD. We conclude that among students, and across all track categories, early intelligence is a weaker determinant of later intelligence than among drop-outs.

The inclusion of the interaction terms does not improve the proportion of variance that is explained by the model, but it accentuates the differences between the effects of the track dummies. Whereas in Model 4 the difference between the effects of ACAD and VOC is 3.37, in Model 5 it is 5.52 (34.05-28.53=5.52). It should be noted however, that in Model 5 the effects of the track dummies are deviations from the intercept along the Y axis, that is where SEKER takes a value of zero. Clearly, a zero value of SEKER falls outside its range of observed values. Since the slopes of VERBAL on SEKER vary somewhat across tracks, the net track effects on later intelligence should be evaluated at realistic values of SEKER.

In Table 3 we present the predicted means of later verbal intelligence for selected groups defined in terms of track, duration of secondary education, and early intelligence. The means are predicted under Model 6 which sets all the insignificant effects in Model 5 to zero. The following points are illustrated by the table: (1) A year of secondary education enhances relative intelligence by 3.4 points; the magnitude of this effect is equivalent to results in American and Scandinavian studies cited by Jencks et al. (1972, p. 88); (2) at all three levels of early intelligence, academic education benefits students by about 4 points relative to the other tracks, this difference is equivalent to

over a year of schooling; and (3) the difference between having no secondary schooling and having some secondary schooling is larger at the lower levels of early intelligence.

The skeptical reader may suspect that the effects of tracks and schooling are due to some uncontrolled factor which determines selection into tracks or which enhances persistence in school. This is clearly a possibility because we can never control for all variables which enter the educational process. However, in Model 7 we include eighth grade grade-point-average. We assume that it is highly correlated with motivation, unmeasured family background variables which benefit educational achievement, and unmeasured intellectual abilities that relate to scholastic performance. Undoubtedly, this variable controls for several unmeasured selection factors. GRADES has a significant effect on later intelligence and its inclusion raises the proportion of explained variance by one percent. It also lowers the main effect of SEKER by four percent, but it does not alter the basic pattern of findings reported earlier.

SUMMARY AND DISCUSSION

The extent to which schooling produces about change in the relative intelligence and scholastic achievements of youth has been the subject of empirical study and controversy. Until quite recently the emerging consensus was that schooling is relatively ineffective in this regard (but see Weinert, in press). This is not to say that students do not learn in school, but only that their relative achievements are quite persistent after the very early pre-school or primary grade years. The demonstrated effects of schooling are larger where there is a closer correspondence between the curriculum and the

subject matter which is being tested; that is, in achievement performance rather than in tested latent abilities. Since the subject matter of ability tests is not usually taught directly as part of the formal curricula in schools, schooling effects on ability are usually found to be smaller than on achievement tests (e.g., knowledge about arithmetic, government, Spanish).

Studies of the effect of schooling on ability usually ignore tracking (e.g., Alexander et al., 1985) and studies of track effects typically employ data on high school seniors (Rosenbaum 1975; Jencks and Brown 1975). Since ability is an important determinant of schooling, low ability students are less likely to reach twelfth grade and to be included in samples of seniors. The present study investigates the simultaneous effects of secondary schooling and tracking on relative intelligence. The results suggest that whereas intra-individual stability in relative intelligence is indeed large, it is by no means complete. Furthermore, relative intelligence is affected by duration and type of educational track. The magnitudes of these effects are not large enough to enable a substantial reshuffling of adolescents along the intelligence hierarchy. However, students with low initial abilities can become average. Low ability students are typically assigned to vocational tracks which when compared to academic education, inhibit growth in intelligence. Thus, some of the constancy in teenage intelligence is due to ability-based educational selection.

An interesting finding of our analysis is that schooling, irrespective of track, facilitates change in relative intelligence: Among early drop-outs continuity in relative intelligence is very high between eighth grade and age seventeen, whereas among those who matriculated into secondary education, continuity is about half as high. We can only speculate about the reasons for

this finding. Exposure to intellectual stimuli is an important determinant of intellectual growth. Dropping out fails to give substantial practice to skills, and without practice, cognitive abilities that underlie scholastic performances can erode (Denney 1982). Consequently, the later relative intelligence of dropouts is determined primarily by their earlier intelligence; their relative intelligence remains constant. By contrast, continuing students attend schools of varying qualities and lengths, with varying student body compositions, teachers' qualifications, and so forth. Hence, they are exposed to varying levels of intellectual stimuli which, in turn, bring about change in relative intelligence among continuing students. For example, a low-ability student who attends a 'good' school may develop faster than an initially able students who attends a 'bad' school.

While schooling yields more change in relative intelligence than does its absence, it also reduces intellectual variability among students within tracks, especially within the academic track (recall Table 1). This finding is not consistent with Rosenbaum's (1975, p. 52) assertion that academic tracks increase variations in intelligence whereas non-college tracks reduce them. However, our findings are consistent with Rosenbaum's conclusion that tracking can alter relative scholastic intelligence--a psychological characteristic which is (erroneously) assumed to be very stable in adolescence.

ENDNOTES

1. Since the early seventies the Israeli educational system has been undergoing structural reforms. The data for the present study has been to a cohort whose members attended school under the old system. Therefore we do not describe the system in its new form, but see Kleinberger (1969) and Yogev (1981).

2. Sternberg (1985) argues that tests of verbal abilities, and tests like SEKER that employ verbal modes of assessing apparently nonverbal skills (arithmetic), are the best tests of general scholastic intelligence. We experimented with a combined military-age intelligence score that reflected both the Raven and progressive matrices (analytical abilities) and the verbal comprehension (verbal abilities) tests. In a principal components analysis, we show (Shavit and Featherman 1985) that the Raven test shares least common variance with tests comprising SEKER and VERBAL. Therefore, we use SEKER and VERBAL as our best indicators of a single common factor of general scholastic intelligence.

3. The reliability coefficient of VERBAL (0.82) was provided by the military testing service. However, we do not have access to data from which reliabilities of VERBAL could be estimated directly.

4. The value of the standardized coefficient in Model 1 is slightly different from the pairwise correlations between SEKER and VERBAL because the models in Table 2 are estimated for cases which have valid data on all variables. The coefficients are not corrected for attenuation because we lack reliability measures for any of the independent variables with the exception of SEKER. Correcting for attenuation would have raised the SEKER coefficient by about ten percent.

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Table 1: Means and Standard Deviations of Variables by Track.

Variable	Total	track: academic	track: vocational	track: other	no secondary education
Early Intelligence	100.00	110.73	94.43	100.79	82.38
SEKER	(15.00)	(11.19)	(13.00)	(13.94)	(10.67)
Later Intelligence	100.00	111.21	97.75	100.90	84.24
VERBAL	(15.00)	(9.42)	(12.32)	(12.60)	(18.92)
Mother's Education	6.68	8.84	4.90	6.57	3.53
MOMED	(4.97)	(4.47)	(4.52)	(5.02)	(4.85)
Father's Education	8.22	10.40	6.65	7.63	5.16
POPED	(4.79)	(4.44)	(4.29)	(4.71)	(4.39)
Ethnicity	0.57	0.39	0.73	0.55	0.80
ETHNIC	(0.50)	(0.49)	(0.45)	(0.50)	(0.40)
Number of Siblings	3.78	2.94	4.29	3.79	6.00
NSIBS	(2.88)	(2.39)	(2.92)	(2.87)	(3.73)
Religiousity	2.14	1.97	2.27	2.13	2.33
RELIG	(1.53)	(1.75)	(1.30)	(1.50)	(1.54)
Months of Educ.	19.77	22.69	20.51	18.44	-
EDUCMOS	(8.14)	(5.21)	(5.99)	(9.44)	-
Academic Track	0.34	-	-	-	-
ACAD	(0.48)	-	-	-	-
Vocational Track	0.36	-	-	-	-
VOC	(0.48)	-	-	-	-
Other Tracks	0.25	-	-	-	-
OTHER	(0.43)	-	-	-	-
No Secondary Educ.	0.05	-	-	-	-
	(0.21)	-	-	-	-
Grades	6.20	7.95	6.55	7.08	6.20
GRADES	(1.38)	(1.14)	(1.30)	(1.29)	(1.38)

Table 2: The Effects of Socioeconomic Background, Early Intelligence, Schooling, and Tracking on Verbal Intelligence at Age Seventeen (standardized coefficients in parentheses).

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SEKER	0.74*	0.66*	0.63*	0.57*	0.92*	1.00*	0.96*
	(0.74)	(0.66)	(0.63)	(0.57)	(0.92)	(1.00)	(0.96)
MOMED		0.22*		0.20	0.21		
		(0.07)		(0.07)	(0.07)		
POPED		0.20*		0.08	0.08		
		(0.04)		(0.03)	(0.03)		
ETHNIC		-1.06		-0.57	-0.56		
		(-0.04)		(-0.02)	(-0.02)		
NSIBS		-0.23		-0.23	-0.19		
		(-0.04)		(-0.04)	(-0.04)		
RELIG		0.19		0.02	0.05		
		(0.02)		(0.00)	(0.01)		
EDUCMOS			0.35*	0.32*	0.32*	0.34*	0.33*
			(0.19)	(0.17)	(0.17)	(0.18)	(0.18)
ACAD			1.63	1.38	34.05*	36.86*	38.48*
			(0.06)	(0.05)	(1.12)	(1.22)	(1.27)
VOC			-2.43	-1.99	28.53*	31.72*	33.38*
			(-0.08)	(-0.07)	(0.93)	(1.03)	(1.08)
OTHER			-2.14	-2.04	28.12*	29.81*	33.05*
			(-0.06)	(-0.06)	(0.81)	(0.86)	(0.96)
ACAD*SEKER					-0.37*	-0.40*	-0.42*
					(-1.35)	(-1.46)	(-1.54)
VOC*SEKER					-0.35*	-0.39*	-0.41*
					(-1.09)	(-1.21)	(-1.26)
OTHER*SEKER					-0.35*	-0.37*	-0.40*
					(-1.03)	(-1.10)	(-1.20)
GRADES							1.20*
							(0.12)
Constant	22.55	32.33	31.30	36.06	6.27	-0.58	-4.97
R-square	.55	.58	.60	.61	.61	.60	.61

* parameter estimate at least twice its standard error.

Table 3: Predicted Means of Later Intelligence by Track and Selected Values of Early Intelligence and Schooling (Under Model 6).

Early Intelligence	Track	Months of Secondary Education 0	10	20	30
90	ACAD	-	96.68	97.08	100.04
	VOC	-	89.33	92.73	96.13
	OTHER	-	89.33	93.03	96.13
	Out of School	89.50	-	-	-
100	ACAD	-	99.68	103.08	106.48
	VOC	-	95.54	98.94	102.34
	OTHER	-	95.63	99.03	102.43
	Out of School	99.42	-	-	-
110	ACAD	-	105.68	109.08	112.48
	VOC	-	101.64	105.04	108.44
	OTHER	-	101.93	105.33	108.73
	Out of School	109.42	-	-	-

APPENDIX

Sample attrition may introduce selection bias if (i) the attrition process is governed by some of the same variables as is the process which is of substantive interest and (ii) if some of the common effects are not fully controlled in the substantive analysis. In such cases the disturbances of the selection and substantive equations are correlated (Berk 1983). When attrition is random with respect to the dependent variable in the substantive equation (in our case - VERBAL), it will not involve sample selection bias (ibid).

In our case selection is due primarily to loss of cases in the retrieval of Seker data. Only five cases were lost in the retrieval of the military data. Thus, attrition may introduce bias with respect to SEKER (which is an independent variable in our analysis) but it is unlikely to be systematic with respect to VERBAL.

The magnitude of bias was evaluated by estimating the correlation between the disturbances of the following equations:

(1) $\text{Probit (S)} = a + b_1(\text{MOMED}) + b_2(\text{POPED}) + b_3(\text{NSIBS}) + b_4(\text{ETHNIC}) + b_5(\text{RELIG}) + e_1$

(2) $\text{SEKER} = a + b_1(\text{MOMED}) + b_2(\text{POPED}) + b_3(\text{NSIBS}) + b_4(\text{ETHNIC}) + b_5(\text{RELIG}) + e_2$

where S is coded 1 if Seker data were available for the respondent and 0 otherwise. Equation 1 was estimated as a probit equation and equation 2 was estimated as an OLS equation.

When equation 1 was estimated in the original sample (n=2144) the correlation between e_1 and e_2 is 0.04. Among Israeli born respondents (1470)

it is zero. We conclude that among native Israelis sample attrition does not involve selection bias (Heckman 1979, p. 158; Berk 1983, p. 396).